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(54) **Electromagnetic lock**

(57) An electromagnetic lock has the holding force of a relatively small and weak electromagnet (10) supplemented by causing the first minimal opening movement of a door (30) to which the lock is applied to result in movement of a hook (24) into engagement with a rod (36) rigid with the electromagnet housing (32), whereby the rod (36) then sustains any additional force applied to the door. The armature (10) of the electromagnet is supported by a mounting plate (12) pivotally supported at (14) on a base plate (16). The hook (24) is pivotally mounted by bar (22) in plate (16). Mouse-trap spring (28) biasses hook (24) to a position in which it clears bar keeper (36), but the minimal opening of the door causes the armature (10), held by electromagnet (34), to tilt plate (12) forwards. This engages end (24A) of the hook and pivots it into engagement with keeper (36). Spring (18) biasses the plate (12) away from base-plate (16) to prevent the hook being released by minimal opening followed by a slow closing.

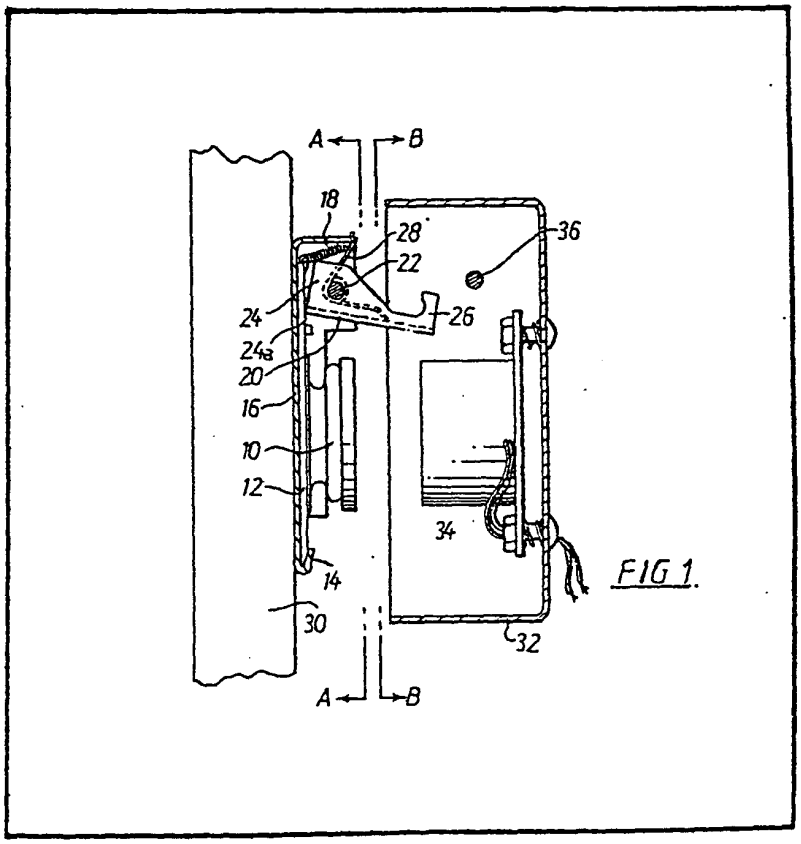

FIG 1.

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

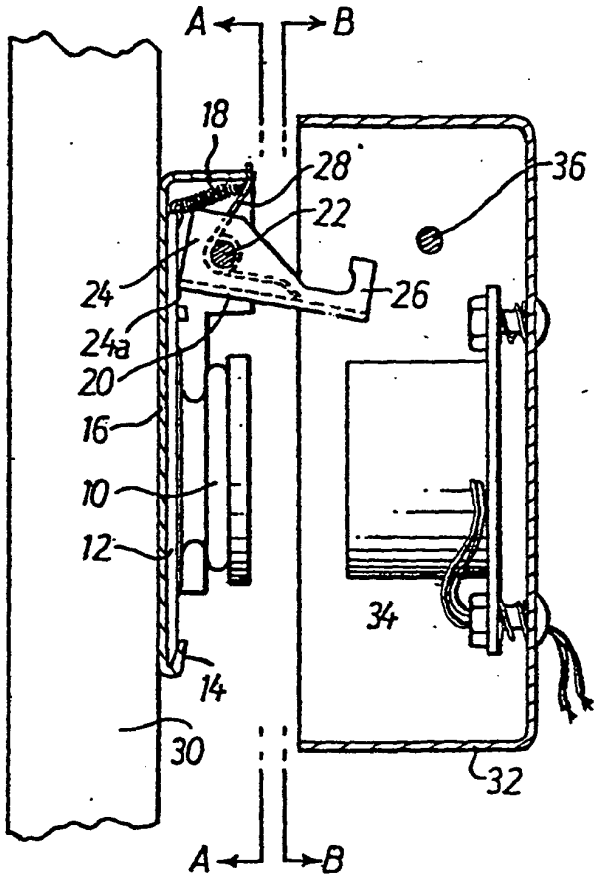

FIG 1.

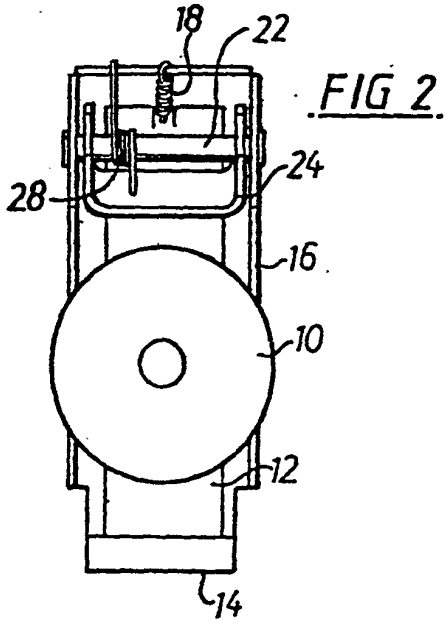

FIG 2.

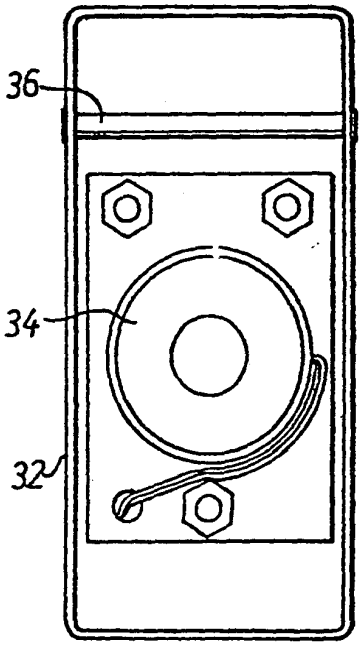

FIG 3.

SPECIFICATION

Electromagnetic lock

The present invention is concerned with the use of electromagnets as door locks.

It is becoming popular in access control systems to use electromagnets as door locks. These are usually units having substantial pole face areas which have two particular disadvantages. Firstly, their large size means that they are relatively expensive. Secondly, the normal use of such magnets gives only about 500 Kg holding force, even from quite large devices. Furthermore, since the holding force will be lost altogether if only a very small air gap is created, the known devices are particularly sensitive to shock and vibration and do not make for strong reliable locking.

It is an object of the present invention to provide an electromagnetic door lock in which the aforegoing problems of the known devices are reduced.

In accordance with the present invention, the holding force of a relatively small and therefore weak electromagnet is supplemented by causing the first minimal opening movement of a door to which the lock is applied to result in movement of a hook latch into engagement with a rod rigid with the electromagnet housing whereby the latter rod then sustains any additional force applied to the door.

When the electromagnet is released, the door is free to move as there is no magnetic source of force to cause the hook latch to move so that it stays clear of engagement with the locking rod.

The invention is described further hereinafter, by way of example only, with reference to the accompanying drawings, in which:—

Fig. 1 is a diagrammatic, partially sectioned, side elevation of one embodiment of a door lock in accordance with the present invention;

Fig. 2 is a view on the line A—A of Fig. 1; and

Fig. 3 is a view on the line B—B of Fig. 1.

The illustrated device comprises an electromagnet armature 10 which is flexibly mounted at an approximately central position on a lever plate 12. The lever plate 12 engages loosely at its lower end in a bent-over portion 14 at the lower extremity of a bracket 16 such that the lower end of the lever plate cannot move forward of the bracket face although tilting of the lever plate relative to the bracket is feasible. The upper end of the lever plate 12 is connected to the upper free end of the bracket by means of a light coil spring 18 which tends to keep the lever plate biassed forwards away from the upright face of the bracket. Extending between parallel side faces 20 of the bracket 16 is a pivot rod 22 on which a hook latch bracket 24 is pivotally mounted. The hook latch bracket 24 defines a pair of parallel, forwardly projecting hooks 26. A mouse-trap spring 28 is also arranged on the pivot rod 22 so as to cause the hook latch bracket 24 to rotate on the pivot rod, thrusting it towards the bracket 16 in such a way as normally to force the upper part of the lever plate flat against the bracket 16.

The abovedescribed assembly is mounted on the door 30 as shown in Fig. 1.

On the door frame (not shown) there is mounted a box 32 containing a relatively small electromagnet 34 (say 15 Kg) and a locking bar 36, the relative positions being such that when the door is brought to its closed position the hook latch 24 enters the box so that the hooks 26 clear just below the locking bar 36 and the armature 10 aligns with the electromagnet 10.

When the electromagnet 10 is energised, it holds the armature and thereby the door. Should someone then pull or push on the door while the magnet is energised, the first incremental movement δ of the door causes a corresponding gap δ to appear between the centre of the lever plate 12 and the adjacent face of the bracket 16. This results in a gap of approximately 2δ appearing at the top of the lever plate 12, thus forcing the lower edge 24a of the hook latch forward relative to the bracket 16 by 2δ. Because of the proportions of the hook latch 24, the hooks 26 themselves rise, in this case by approximately 6δ, so that they engage behind the rod 36. The application of a greater force may serve to break the hold between the magnet and the armature and leave the door held by the engagement of the hooks 26 with the rod 36. Were it not, therefore, for the presence of the light spring 18, the lever plate 12 might flex back and leave a situation where releasing the pressure on the door slowly could drop the hooks 26 (by virtue of the mouse-trap spring) and bring the door to an unlocked position without snapping the armature back onto the electromagnet. The presence of the spring 18 reliably prevents this happening.

Claims (Filed on 11/5/83)

1. An electromagnetic lock wherein the holding force of a relatively small and weak electromagnet is supplemented by causing the first minimal opening movement of a door to which the lock is applied to result in movement of a hook latch into engagement with a rod rigid with a housing of the electromagnet, whereby the latter rod then sustains any additional force applied to the door.

2. An electromagnetic lock comprising an electromagnet adapted to be fixed to one of the two members consisting of a door frame and a pivotable door, an armature carried by a mounting plate which is pivotably supported on a base plate adapted to be fixed to the other of said two members, a locking bar adapted to be fixed rigidly relative to said one member, and a hooked latch which is pivotably mounted on the base plate, the arrangement being such that when the door is brought to its closed position, whether the electromagnet is energised or not, the hooked latch normally lies clear of the locking bar but, when the door is in a closed state with the electromagnet energised, a small opening movement of the door results in a pivotal

movem nt of th mounting plate which is arranged to be transferred to the hooked latch to bring same into locking engagem nt with said l cking bar.

3. An electromagn tic lock as claimed in claim 2, wherein the hooked latch is biassed in a pivotal direction away from the locking bar by a first spring and the mounting plate is biassed in a pivotal direction away from the base plate by a second spring, the effective force of the first spring being greater than that of the second spring whereby the first spring is effective normally to urge the mounting plate against the base plate by mechanical engagement of the hooked latch with the mounting plate.

4. An lectromagnetic lock as claimed in claim 3, wh rein wh n the hooked latch is in engagement with the locking bar, said second spring is effectiv to pivot the mounting plat away from the base plate sufficient to maintain the hooked latch and locking bar in their interengaged condition.

5. An electromagnetic lock as claimed in claim 1, 3 or 4 wherein the electromagnet and the locking bar are mounted in a common rigid housing which is adapted to be fixed to said one of the members.

6. An electromagnetic lock substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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